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Roles of Swidden Fallows for Free-grazing Water Buffalo in Northern Laos

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Abstract

In northern Laos, water buffaloes have been managed under free-grazing condition on swidden fallow lands as an effective practical use of previously cultivated fallow lands. However, there is little information about how water buffaloes utilize the mosaic environments which consist of patchy biotopes. We investigated the spatiotemporal use of swidden fallow lands by four water buffaloes using animal-borne GPS data-logger and satellite image analysis in August, 2011, in the village of Kachet. Villagers in Kachet use a relatively long fallow period (7 years) compared to other villages in northern Laos. All water buffaloes stayed in a 6-year-old fallow plot during the daytime hours, while they moved to a 1-year-old fallow plot by sunset, and spent time there until sunrise. We hypothesize that water buffaloes might stay in the older fallow plot with tree-shade areas during the day to regulate their body temperature because the buffaloes have few sweat glands and have a poor ability to maintain body temperature. The younger fallow plot was also useful for the animals: it was covered with various germinated plants and was utilized as feeding grounds by the water buffaloes. Our results suggested that plots of varying fallow periods have different roles for water buffalo. The spatial heterogeneity in swidden fallows might provide suitable grazing ground for water buffalo.

Keywords: Water buffalo grazing, Swidden fallow management, northern Laos

Introduction

Swidden cultivation, also commonly known as slash-and-burn agriculture, is the major land-use practice in the mountainous areas of northern Laos [1]. This type of agricultural system in Laos is characterized by three rotational phases: (1) clearing a vegetation patch through slash-and-burn methods, (2) growing a variety of crops for 1 or 2 seasons, and (3) moving to a plot of fallow that had been previously used.

Swidden land can be considered an "agricultural field" for food production in the first year after slashing and burning, while the following fallow plots return to "forest" [2]. The fallow plots are used for livelihood activities, such as the grazing of livestock, and further utilized as a source of plants and insects, and even for hunting. Because it is difficult to evaluate the economic value of fallow plots after cultivations, in comparison to land under active agricultural use, discussions concerning the roles and values of swidden fallow plots have been little available [3].

Of the activities practiced in the swidden fallow plots, livestock grazing is one of the most important in the livelihoods of rural residents. Water buffaloes, the main livestock raised in Laos [4], play a vital role in overall social development

through contributions to draft power for agricultural operations [5]. They also serve the immediate needs of the rural communities as an income source. However, there is little information about how water buffaloes utilize the mosaic environments of swidden fallow plots, which consist of patches of land with varying fallow periods.

The aim of this study is to investigate grazing patterns of water buffaloes in relation to swidden fallow plots, in northern Laos.

Material and Methods

Our study was conducted in the village of Kachet (20°34'N, 102°18'E), in the province of Luan Phabang, Lao PDR, in August of 2011. The village is located about 27 km from the city of Nam Bak, northwestern part of the Luang Phabang province of northern Laos. As of 2011, the village comprised 486 individuals from 98 households belonging to the Khmu people. As in the case of other communities in northern Laos, the villagers of Kachet practice swidden agriculture.

In Kachet, water buffaloes were kept on first-year fallow plots that had been cultivated in previous years. According to the village chief,

Kachet has 15 water buffaloes, which graze all day under free-ranging conditions. Every year, the residents release water buffaloes to the fallow area after the harvest of the 1-year-old fallow area. In 2011, the 1-year-old fallow areas were mainly located 1.0–2.4 km south of the village. The residents usually walk to the area once a week in order to check on the buffaloes.

To create the land use map for swidden cultivation in the Kachet village, we used true-colour images from the Landsat-ETM+ satellite (Row46/Path129) over 8 years [6]. The data were selected from October to January of the next year because harvesting had finished and tree cutting had not yet begun. Just after the swidden cultivation, the land is recorded as a bare area in the satellite images. We compared the true-colour images between two consecutive years, from 2003 to 2010. Using comparisons in the geographic information system (ArcGIS 10, ESRI Inc.), we designated the areas that changed from forest to bare area as swidden cultivation areas.

Animal-borne GPS data loggers (GT-600, Mobile Action Inc.) were sealed into small plastic cases and attached to collars on four water buffaloes [7]. The loggers were programmed to record date, time, latitude and longitude every five minutes. The overall weight of the device and collar was approximately 200 g. All loggers were recovered after a period of 22 to 23 hours, and all recorded data were downloaded successfully. GPS tracking data of water buffalo were combined with the map of swidden fallow areas in ESRI ArcGIS to determine the proportion of time spent grazing in each category of land use.

Results

By using satellite image analysis, we found that Kachet has fallow cycle of at least 7 years (Fig. 1). The mean annual cultivated area between 2003 and 2010 was 157 ha.

All water buffalo stayed in the 6-year-old fallow plot, which adjoined the 1-year-old fallow area, during daytime hours (Fig. 2). The buffaloes then moved to the 1-year-old fallow plot by sunset (Fig. 2).

Discussion

Our results showed a 7-year fallow cycle in Kachet, which is longer than normal; swidden agriculture in northern Laos is typically practiced with about a five-year cycle [8][9]. Thus, the

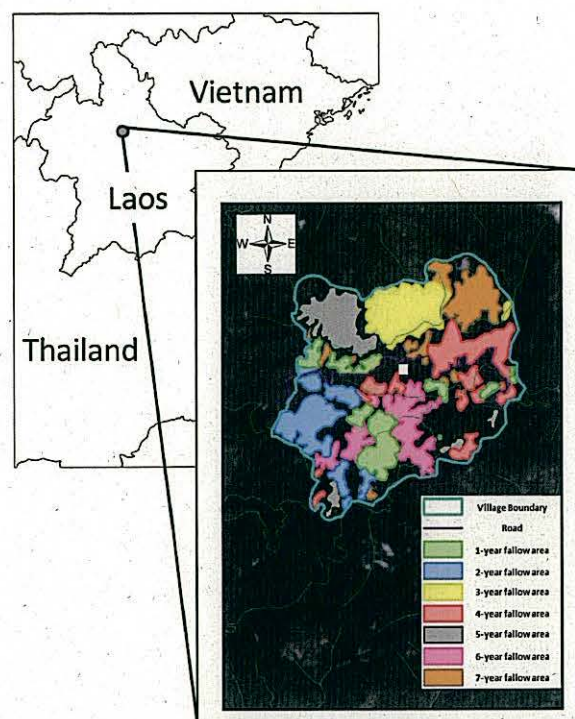


Fig. 1: The distribution of the cultivated areas in the village of Kachet from 2003 to 2010. The white square represents the position of the village.

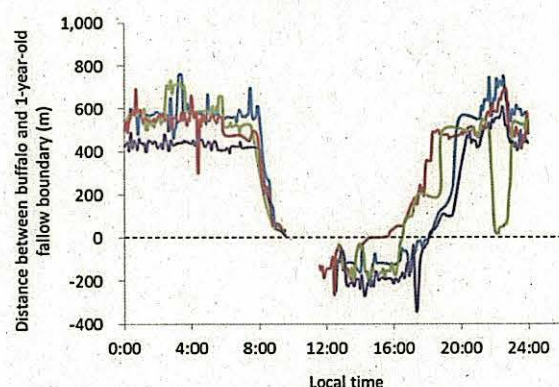


Fig. 2: Distance of water buffalo to the first-year fallow boundary by time of day. A positive value on the vertical axis indicates that the water buffalo was in the 1-year-old fallow area, while a negative value indicates that it was in the adjacent 6-year-old fallow area. The different colours represent different individuals.

fallow period in Kachet is relatively long compared to other villages in northern Laos.

Water buffaloes in Kachet stay in the 6-year-old fallow plot during the day, and stay in the 1-year-old fallow plot at night. Generally, water buffaloes have a poor ability to maintain body temperature because they have fewer sweat glands than cattle [10]. Since the older fallow plots with more mature trees provide comfortable shade to

water buffaloes, their behaviour may be explained as an adaptation to the hot environment.

Further, water buffaloes usually spend more time feeding at night than during the day in order to mediate energy and water loss [11]. As younger fallow plots were covered with various germinated plants [12], the movement of water buffalo to the 1-year-old fallow plot at night suggests their migration to the area is a foraging behaviour.

Our results suggest that plots of varying fallow periods have different roles for water buffalo. The spatial heterogeneity in swidden fallows might provide suitable grazing ground for water buffalo by providing a variety of resources. Although Kachet has a relatively long fallow period compared to other villages in northern Laos, the fallow periods in Laos have decreased overall as a result of increasing population and demand on resources, as well as the Land and Forest Allocation Policy implemented by the local government [13]. The reduction of fallow periods may reduce the opportunities for buffaloes to shelter in tree-shaded areas. Therefore, the decrease in numbers of water buffalo in northern Laos [14] may partially be influenced by the changes in swidden agricultural management. For the sustainable management of water buffaloes, further information is required regarding the relationship between the animals' behaviours and swidden cultivation practices.

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